7.1 What is Air Made up of?

A. Fill in the blanks

Fill in the blanks in the diagram below which shows the composition of air.

- 78% nitrogen
- 21% oxygen
- 0.932% inert gases
- 0.03% carbon dioxide

B. Questions

1. An experiment was carried out as shown in the diagrams below.
(a) Draw what would happen to the water level and the flame in diagram C. (2)

(b) What do the results of this experiment show? (2)

This experiment shows that air contains about 20% of oxygen.

(c) What would happen if the candle used is too short? (2)

If the candle used is too short, the rising water may extinguish the candle.

---

2. A can of iced Coke is left on the table. After some time, some liquid droplets appear on the surface of the can.

(a) What is the liquid on the can surface? (1)

It is water.

(b) How can you test for the liquid? (2)

It turns dry cobalt chloride paper from blue to pink.

(c) Where does the liquid come from? (1)

It comes from the ice.

(d) How does the liquid form? (2)

Water vapour condenses on cool surface to form water.
3. A bag of breathed air is collected by blowing into a transparent plastic bag.

Add a little hydrogen carbonate indicator to the bag and then shake the bag.

(a) What happens to the hydrogen carbonate indicator? (1)
It changes from red to yellow.

(b) What do the results of this experiment show? (2)
The results show that breathed air contains carbon dioxide.

C. Matching
Match the gases in the left column with the correct test methods in the right column.

<table>
<thead>
<tr>
<th>Gases</th>
<th>Test methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. oxygen</td>
<td>It turns lime water milky.</td>
</tr>
<tr>
<td>2. carbon dioxide</td>
<td>There is no simple test for this gas.</td>
</tr>
<tr>
<td>3. water vapour</td>
<td>It relights a glowing splint.</td>
</tr>
<tr>
<td>4. nitrogen</td>
<td>It turns cobalt chloride paper from blue to pink.</td>
</tr>
</tbody>
</table>
D. Complete the table

Complete the table below to compare the compositions of breathed and unbreathed air.

<table>
<thead>
<tr>
<th></th>
<th>Breathed air</th>
<th>Unbreathed air</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Oxygen</td>
<td>less</td>
<td>more</td>
</tr>
<tr>
<td>2. Carbon dioxide</td>
<td>more</td>
<td>less</td>
</tr>
<tr>
<td>3. Water vapour</td>
<td>more</td>
<td><em>variable</em></td>
</tr>
<tr>
<td>4. Temperature</td>
<td>higher</td>
<td>lower</td>
</tr>
</tbody>
</table>

7.2 Burning

A. Questions

1. Study the apparatus below and answer the following questions.

   (a) What happens to the dry cobalt chloride paper? (1)
   
   It turns from blue to pink.

   (b) What happens to the lime water? (1)
   
   It turns milky.

   (c) What do the results show? (3)
   
   The results show that water and carbon dioxide are formed by a burning candle.
2. Complete the table below which shows different ways of putting out fires.

<table>
<thead>
<tr>
<th>Burning fuel</th>
<th>How the fire is put out</th>
<th>Which part(s) of the fire triangle is/are taken away</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood</td>
<td>water</td>
<td>heat</td>
</tr>
<tr>
<td></td>
<td></td>
<td>oxygen</td>
</tr>
<tr>
<td>Wax</td>
<td>carbon dioxide, foam, dry powders, fire blankets</td>
<td>oxygen</td>
</tr>
<tr>
<td>Oil</td>
<td>carbon dioxide, foam, dry powders, fire blankets</td>
<td>oxygen</td>
</tr>
</tbody>
</table>

B. True or False

Study each of the following statements. Put a ‘✓’ in the box against a true statement and a ‘✗’ against a false statement.

1. Fuel, oxygen and heat form a fire triangle.  
   ![✓](✓)

2. Most fuels contain carbon. Carbon dioxide is formed when fuels burn in air.  
   ![✓](✓)

3. A fire blanket is put over the fire to lower the temperature.  
   ![✗](✗)

4. A fire extinguisher takes away all the three components of the fire triangle.  
   ![✗](✗)
7.3 How do we Obtain Energy?

Questions

1. List four of your daily body activities that require energy. (2)
   Any four of the following: playing ball games, doing homework, studying, doing exercise, doing housework ...

2. Do you require energy while you are sleeping? Explain your answer. (3)
   We still require energy while we are sleeping. The energy is used for keeping warmth, keeping the heart beating and continuing breathing.

3. The table below shows the energy content of some foods.

<table>
<thead>
<tr>
<th>Food</th>
<th>Weight (g)</th>
<th>Energy (kJ)</th>
<th>Energy (kJ/100 g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butter</td>
<td>250</td>
<td>7800</td>
<td>3120</td>
</tr>
<tr>
<td>Cabbage</td>
<td>600</td>
<td>204</td>
<td>34</td>
</tr>
<tr>
<td>Apple pie</td>
<td>300</td>
<td>5250</td>
<td>1050</td>
</tr>
<tr>
<td>Chocolate</td>
<td>400</td>
<td>9600</td>
<td>2400</td>
</tr>
<tr>
<td>Milk</td>
<td>1000</td>
<td>2700</td>
<td>270</td>
</tr>
</tbody>
</table>

(a) Calculate the amount of energy per 100 g of each of the foods. Put the answers in the table. (5)

(b) Which of the foods contains the highest energy content per 100 g? (1)
   butter:

(c) What would happen if you eat more food than you need? (2)
   My body would store it as fat. The result is that my body weight would increase.
7.4 How do Green Plants Obtain Energy?

A. Fill in the blanks

Complete the following with suitable words.

1. The process by which green plants make their own food is called (a) ________

2. The raw materials for green plants to make food are (b) ________ and (c) ________.

3. Energy is needed for photosynthesis. The energy comes from (d) ________.

4. Only green plants carry out photosynthesis because they have (e) ________ which can absorb (f) ________.

5. During photosynthesis the energy from (g) ________ is converted into (h) ________ energy in (i) ________.

B. True or False

Study each of the following statements. Put a ‘✓’ in the box against a true statement and a ‘✗’ against a false statement.

1. The main product of photosynthesis is starch and the by-product is oxygen.  ✓

2. Iodine solution turns from brown to blue-black when starch is present. ✓

3. Hot alcohol can remove starch from a leaf.  ✗

4. A variegated leaf can be used to show that chlorophyll is necessary for photosynthesis. ✓

5. Light, chlorophyll and oxygen are necessary for photosynthesis.  ✗

6. You can destarch a leaf by putting it in boiling water for two minutes.  ✗
C. Label the diagram

- Light energy
- Carbon dioxide
- Chlorophyll
- Starch
- Water
- Oxygen

D. Questions

The diagrams below show the steps involved in testing for starch in green leaves.

1. Use the numbers on the diagrams to show the correct sequence of the test. (2)
   (3), (2), (1), (4)
2. What are the purposes of steps (2) and (3)? (3)
   - Step (2) - to remove chlorophyll from the leaf
   - Step (3) - to kill the leaf cells and make the leaf soft

3. If starch is present in the leaf, what would be the result? (1)
   The leaf becomes blue-black in colour when iodine solution is added onto it.

4. What inference can be made if starch is detected in the leaf? (1)
   The leaf has carried out photosynthesis.

7.5 Gaseous Exchange in Animals and Plants

A. True or False

Study each of the following statements. Put a '✓' in the box against a true statement and a '✗' against a false statement.

1. Gaseous exchange means breathing in. ✗
2. Gaseous exchange is another term for respiration. ✗
3. The oxygen we breathe in can break down food to release energy ✓
4. The balloon-bell jar model is used to demonstrate the process of respiration. ✓
5. Green plants carry out photosynthesis in the daytime and respiration at night. ✗
6. Green plants take in carbon dioxide in bright light and give out carbon dioxide in the dark. ✓
B. Questions

1. The experimental set-up below shows that animals breathe.

(a) What is the function of the soda lime? (1)
It absorbs carbon dioxide.

(b) What happens to the coloured liquid index? (1)
The coloured liquid index moves towards the grasshopper.

(c) How can you explain the results of the experiment? (3)
When the worms breathe, oxygen is taken in and carbon dioxide is given out. The soda lime absorbs carbon dioxide.

(d) How can you set up a control for this experiment? (2)
The control has the same set-up without the worms.

2. The diagrams below show the human respiratory system and a balloon-bell jar model.
(a) Name the parts D, E, F, and H. (4)

D — intercostal muscles  E — air sac  F — nb  H — diaphragm

(b) Explain how parts D and H help during breathing in. (5)

When breathing in, D moves upwards and H becomes flattened. This increases the volume of the chest and lowers the pressure inside it, so air passes into the lungs.

(c) Using the letters from diagram I, indicate the parts corresponding to those in diagram II. (4)

glass tube — 3  Y piece — C  balloon — G  rubber sheet — H

3. Your little sister does not understand why the chest of your cat keeps expanding and contracting. Can you explain this to her?

When the chest of the cat expands, its volume (a) increases. This (b) lowers the pressure inside the chest, and so air (c) enters the lungs. When the chest of the cat contracts, its volume (d) decreases. This (e) raises the pressure inside the chest, so air is (f) forced out from the lungs.
7.6 Interdependence of Plants and Animals in Nature

A. Questions

Study the diagram below:

1. Name processes X and Y. (2)
   
   X = photosynthesis  
   Y = respiration

2. What is gas A? Why is the amount of gas A in the atmosphere increasing? (3)

   Gas A is carbon dioxide. 
   The amount of carbon dioxide in the atmosphere increases because of deforestation and burning of too much fossil fuel.

B. Fill in the blanks

Complete the sentences below with suitable words.

1. Green plants can absorb (a) sunlight to make food by (b) photosynthesis. They are called (c) producers.

2. Animals cannot make their own food. They eat plants, or they eat animals that eat plants. They are called (d) consumers.

3. We can link living things according to their feeding relationships. It is called a (e) food chain which usually starts with a (f) green plant.
7.7 Effect of Smoking and Polluted Air on our Respiratory System

A. Questions

Answer the following questions.

1. Name the three harmful substances in cigarette smoke and state one effect of each on our health. (6)

<table>
<thead>
<tr>
<th>Harmful substance in cigarette smoke</th>
<th>Effect on our health</th>
</tr>
</thead>
</table>
| Tar                                  | • It sticks to the walls of trachea and air sac.  
• It causes lung cancer.        |
| Nicotine                             | • It causes heart disease.               
• It causes addiction to cigarette smoke. |
| Carbon monoxide                      | • It lowers the amount of oxygen carried by blood. |

2. Draw a labelled diagram of a set-up used to show the presence of tar in cigarette smoke. (3)
B. Matching

Match the pollutants in column I with the effects on our health in column II.

<table>
<thead>
<tr>
<th>Pollutants</th>
<th>Effects on our health</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sulphur dioxide</td>
<td>D. lowers the amount of oxygen carried by blood.</td>
</tr>
<tr>
<td>3. Carbon monoxide</td>
<td>A. forms acid rain.</td>
</tr>
<tr>
<td>4. Lead</td>
<td>B. causes asthma and bronchitis.</td>
</tr>
</tbody>
</table>

C. True or False

Study each of the following statements. Put a '✓' in the box against a true statement and a '✗' against a false statement.

1. There are only four kinds of air pollutants. ✗

2. In Hong Kong, all the people dying of lung cancer are cigarette smokers. ✗

3. Even if you do not smoke, you may breathe in smoke by passive smoking. ✓

4. API is based on the measurement of respirable suspended particles. ✗

5. The air quality monitoring stations are operated by the Environmental Protection Department. ✓
A. True or False

Study each of the following statements. Put a ‘✓’ in the box against a true statement and a ‘✗’ against a false statement.

1. Carbon dioxide turns hydrogen carbonate indicator yellow. ✓
2. The most abundant gas in air is oxygen and the second one is nitrogen. ✗
3. Since nitrogen is a very unreactive gas, it can be used to put out a fire. ✗
4. Respiration takes place in lungs. ✗
5. When we breathe in, the ribs move upwards and the diaphragm flattens out. ✓
6. Iodine solution turns colourless when starch is present. ✗
7. The carbon dioxide we breathe out is produced in the air sacs of the lungs. ✗
8. We can destarch a plant by keeping it in darkness for at least 24 hours. ✓
9. The arrows in a food chain show the direction in which energy is passed from one type of living organism to another. ✓
10. There are only three kinds of harmful substances in cigarette smoke. They are tar, nicotine and carbon monoxide. ✗

B. Multiple-Choice Questions

Write the correct answer to each question in the box provided.

1. Which of the following is the best test for the presence of oxygen?
   A. test with lime water  
   B. test with hydrogen carbonate indicator  
   C. test with pH paper  
   D. test with a glowing splint  
   D
2. Which of the following data on the composition of air is correct?

<table>
<thead>
<tr>
<th>Oxygen (%)</th>
<th>Carbon dioxide (%)</th>
<th>Nitrogen (%)</th>
<th>Inert gases (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>21</td>
<td>0.03</td>
<td>78</td>
</tr>
<tr>
<td>B.</td>
<td>21</td>
<td>0</td>
<td>78</td>
</tr>
<tr>
<td>C.</td>
<td>16</td>
<td>4</td>
<td>70</td>
</tr>
<tr>
<td>D.</td>
<td>16</td>
<td>0</td>
<td>70</td>
</tr>
</tbody>
</table>

3. When carbon dioxide is poured into a jar containing a burning candle, the candle goes out.

This shows that

A. carbon dioxide is lighter than air.
B. carbon dioxide is heavier than air.
C. carbon dioxide does not support burning.
D. carbon dioxide is heavier than air and does not support burning.

4. Which of the following processes does NOT release carbon dioxide into the atmosphere?

A. burning town gas
B. baking bread in an oven
C. respiration in animals
D. smoking

5. During the iodine test for the presence of starch in a leaf, the leaf has to be put in boiling alcohol. The purpose of this step is to

A. kill the cells in the leaf.
B. sterilize the leaf.
C. remove starch from the leaf.
D. remove chlorophyll from the leaf.
6. What is the colour of the hydrogencarbonate indicator in each test tube after one hour?

A. The indicator in both tubes turns yellow.
B. The indicator in both tubes remains red.
C. The indicator in tube X turns yellow while that in tube Y remains red.
D. The indicator in tube X remains red while that in tube Y turns yellow.

7. What is the colour of the hydrogencarbonate indicator in each test tube after half an hour?

A. The indicator in both tubes turns yellow.
B. The indicator in both tubes remains red.
C. The indicator in tube X turns yellow while that in tube Y remains red.
D. The indicator in tube X remains red while that in tube Y turns yellow.

Directions. Questions 8 and 9 refer to the diagram below:

8. [Diagram showing hydrilla before and after three days]
9. [Diagram showing gas X before and after three days]
8. The purpose of this experiment is to show that the water plant
   A. needs air.
   B. gives out a gas.
   C. gives out carbon dioxide.
   D. is affected by water pressure.

9. Gas X can
   A. burn.
   B. relight a glowing splint.
   C. turn lime water milky.
   D. turn hydrogencarbonate indicator yellow.

10. Over 95% of the air is made up of two gases. They are
    A. nitrogen and carbon dioxide.
    B. nitrogen and oxygen.
    C. inert gases and nitrogen.
    D. oxygen and water vapour.

11. Which of the following beakers will contain the most carbon dioxide?
    A. 
    B. 
    C. 
    D. 

Directions: Questions 12 to 14 refer to the table below which shows four gas jars containing different gases:

<table>
<thead>
<tr>
<th>Gas jar Content</th>
<th>W</th>
<th>X</th>
<th>Y</th>
<th>Z</th>
</tr>
</thead>
<tbody>
<tr>
<td>air</td>
<td></td>
<td>breathing air</td>
<td>nitrogen</td>
<td>inert gas</td>
</tr>
</tbody>
</table>

12. A lighted candle is lowered into each gas jar and then the gas jar is covered again. In which gas jar(s) will the lighted candle burn?
   A. W only
   B. W and X only
   C. W, X and Y only
   D. W, Y and Z only
13. Lime water has been added to each jar and shaken. In which gas jar(s) will the lime water turn milky?
   A. W only
   B. X and Y only
   C. W and X only
   D. X and Z only

14. Which of the following substances in cigarette smoke causes addiction?
   A. carbon monoxide
   B. carbon dioxide
   C. tar
   D. nicotine

15. Which of the following statements about cigarette smoking is correct?
   A. Nicotine causes lung cancer.
   B. Tar causes heart disease.
   C. Tar causes addiction to smoking.
   D. Carbon monoxide lowers the amount of oxygen carried by blood.

16. Which of the following cause the amount of carbon dioxide in the atmosphere to increase?
   (1) cutting down a large number of trees
   (2) burning too much fossil fuels
   (3) population increase
   A. (1) and (2) only
   B. (1) and (3) only
   C. (2) and (3) only
   D. (1), (2) and (3)

17. Which of the following statements about variegated leaves is INCORRECT?
   A. They have green and non-green parts.
   B. They do not have any chlorophyll.
   C. They can make starch.
   D. They can be used to show that chlorophyll is necessary for photosynthesis.

18. Which of the following statements about greenhouses is INCORRECT?
   A. A greenhouse is a house which is painted green.
   B. A greenhouse has a glass roof.
   C. The temperature inside a greenhouse is higher than that outside.
   D. Plants grow better inside a greenhouse.
19. People with heart disease and respiratory diseases are advised to reduce outdoor activities when the API is greater than
   A. 25.
   B. 50.
   C. 100.
   D. 200.

20. Three leaves were left on a plant in full sunlight. These three leaves are shown in the diagrams below:

After 4 hours they were removed from the plant and tested for starch. Which of the following represents the results obtained?

A.  

B.  

C.  

D.  
C. Concept map

The following is the concept diagram of Unit 7. Fill in the blanks with suitable words.

Air
- contains oxygen
- contains carbon dioxide
- contains nitrogen
- contains inert gases
- contains waste gases
- contains water vapour
- contains air pollution

1. oxygen
   - supports burning
   - can produce fire
   - fire triangle

2. heat
3. oxygen
4. fuel

5. photosynthesis
   - produces products
   - used by plants
   - therefore plants are called producers

6. respiration
   - produces energy
   - depends on gas exchange

7. respiratory system
   - can be affected by smoking
   - harmful substances in cigarettes

8. tar
9. nicotine
10. carbon monoxide
11. consumers
12. food chains
13. inert gases
14. waste gases
15. air pollution

16. the release of harmful substances into the atmosphere

17. in mammals, this occurs at
18. the passage of living things according to their feeding relationships
19. heart disease
D. Questions

1. A student wants to carry out an experiment to show that carbon dioxide is necessary for photosynthesis. He/She sets up the apparatus as shown in the diagram below:

(a) What should be done to the potted plant before the experiment? Why is this treatment necessary? (2)

Leave the potted plant in darkness for at least 24 hours in order to destarch the plant.

(b) The apparatus is not set up properly. How can you correct them? (2)

The cotton wool should be replaced by soda lime. The distilled water should be replaced by sodium hydroxide solution.

(c) What is the function of the plastic bag in this experiment? (2)

The plastic bag avoids carbon dioxide released by soil organisms from affecting the result.
(d) Describe the tests which should be done to the leaf in order to complete the experiment. (4)

- Put the leaf in boiling water for about two minutes.
- Put the leaf in boiling alcohol for about ten minutes.
- Put the leaf in hot water for about half a minute.
- Cover the leaf with iodine solution.

2. John found two unlabelled cylinders of gases in the science laboratory. He also found two labels on the bench. One has ‘CO₂’ written on it and the other has ‘O₂’ written on it. Suggest how you could help him to label the cylinders correctly. (2)

Pump the two gases into lime water respectively. The one which can turn lime water milky is carbon dioxide. The other one is oxygen.

3. The following is a balloon-bell jar model.

(a) Name the parts of the human breathing system that each structure of the bell jar model represents. (4)

(b) What happens to the balloons when the rubber sheet is released? Does this represent the process of breathing in or breathing out?

They become bigger. This represents the process of breathing in.
4. Study the apparatus below:

(a) What is the function of the soda lime in the experiment? (1)
   It absorbs carbon dioxide of the incoming air.

(b) What happens to the lime water after 5 minutes? (1)
   It turns milky.

(c) What does the result of this experiment show?
   The rat gives out carbon dioxide.

5. The diagram on the right shows an aquarium set up by a student. It is put near the window.

(a) What do the snails need in order to survive? (2)
   The snails need oxygen and food.

(b) How do the snails get these substances? (3)
   The snails eat the freshwater plants as food and obtain oxygen released by the freshwater plants during photosynthesis.

(c) State one substance that the freshwater plants can obtain from the snails.
   Carbon dioxide

(d) What will happen to the snails and plants if the aquarium is kept in dark all the time? Why? (3)
   If the aquarium is kept in dark, both the snails and plants will die because the plants cannot carry out photosynthesis to make food for survival and produce oxygen for the snails to breathe.
Part 3. Take Up the Challenge

© 1. Air pollution is serious today. The roadside air pollution indices (APIs) in Central, Causeway Bay and Mongkok are 149, 140 and 129 respectively, which are in the 'very high' level.

The Environmental Protection Department states that the air pollutant in these regions is mainly nitrogen dioxide. People with existing heart or respiratory illnesses are advised to reduce outdoor activities.

(1/8/2001 Ming Pao)

(a) What is the range of API in 'very high' level?
101-200

(b) Which three districts have the highest air pollution index today? Why are the air qualities of these districts worse than other districts?
Central, Causeway Bay and Mongkok. These districts are busy commercial areas with heavy traffic, so the air qualities are worse than other districts.

(c) Besides nitrogen dioxide, the air pollution index is also based on the concentrations of other air pollutants. What are they?
Sulphur dioxide, ozone, carbon monoxide and respirable suspended particles.
2. Study the graphs below and answer the following questions.

(a) How does the number of Form 1 to Form 3 students who are smokers change from 1994 to 1999?

The number of students who are smokers increases.

(b) What is the relationship between smoking status and the occurrence of respiratory symptoms?

Smokers are more often to have cough and sore throat than non-smokers.

(c) Besides the symptoms mentioned above, how does smoking affect our health?

Smoking causes lung cancer, heart disease and lowers the amount of oxygen carried by blood.